broken by this longitudinal opening so that if flattened, the total open area would resemble a dumbbell. On the sides of the grain, the alveoli do not appear to be geometrically balanced in any of the species. Where the reticulation follows a similar pattern in all of the grains examined, I have called it regular in spite of a lack of an exact geometric pattern. In many species, polar areas may be defined or not, but the reticulation over the remainder of the surface of the pollen grain appears to be randomly placed (FIG. 5). I have called this type of reticulation irregular.

In most of the species, the reticulation is further decorated by spines arising from the top and sides. The spines all appear to be simple conical protuberances of the same material from which the reticulum is formed. *V. albo-violacea* De Wild. has almost no spines on the reticulum. The spines on pollen grains of other species vary from small to large, but they are uniform in size for a species. Only *V. bojeri* Less., *V. gerberiformis* Oliver & Hiern, *V. mandrarensis* Humbert, and *V. prolixa* S. Moore lack spines completely.

The reticulation of *V. gerberiformis* is unusual among the species examined. The reticulation is relatively narrow and produced upward from the surface of the grain in a wing-like projection (FIG. 3). I shall make no attempt to formulate an adaptive advantage for this deviation from the usual pattern among the *Vernonia* pollen grains studied. With an average pollen diameter of 66.3 μ (measured at the outside of the reticulum), this is the second largest grain examined.

The surface of the pollen grains was examined under oil immersion (485 $\times$) in order to study the surface details. In none of the grains was a regular pattern or design seen. Some of the reticula and pollen surfaces are not smooth. The roughness is not readily discernible and does not appear to be produced in a regular pattern. However, the reticulation on some of the species (for example, *V. adoensis* Sch.-Bip. ex Walp., *V. gerberiformis*) is not completely contiguous with the surface of the pollen grain. When the reticulum is heavy, it frequently stands above the grain surface on a series of pedestals which may be relatively far apart or rather close together (FIG. 2). The presence of the pedestals negates the possibility that this is an artifact created when the surface of the grain shrinks away from the reticulum. In the pollen grains of other species with an equally heavy reticulum, the elevation of the reticulation above the surface does not seem to be present.

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by species; the upper grain shows the elongate alveolus connecting the poles; note the pore at the equator. FIG. 2, *Vernonia adoensis* (oil immersion), note the spaces between the reticulum and the pollen grain surface on the upper left quarter. FIG. 3, *Vernonia gerberiformis*, average pollen diameter 66.3μ; the wing-like extension of the reticulum has been observed only in this species. FIG. 4, *Vernonia adoensis*, average pollen diameter 59.8μ; note the three pores in the median section. FIG. 5, *Vernonia castellana*, average pollen diameter 48.5μ; this shows the thin, irregular reticulum common to several species with a basal rosette of leaves.

On the basis of the gross morphological characteristics of specimens and on a detailed study of the achenes and flowers, the species have been grouped into clusters which show similarities. Pollen grain data have been regrouped (TABLE 1) on this basis (excluding species which apparently do not belong to section STENGELIA). In general, the characteristics of the pollen grains seem to support the groupings by overall morphology. For instance, the first group of three species, *V. lasiopus* O. Hoffm. in Engl., *V. brownii* S. Moore, and *V. albo-violacea*, varies relatively little in average pollen grain diameter; the grains have reticula of medium thickness with short or nearly absent spines.

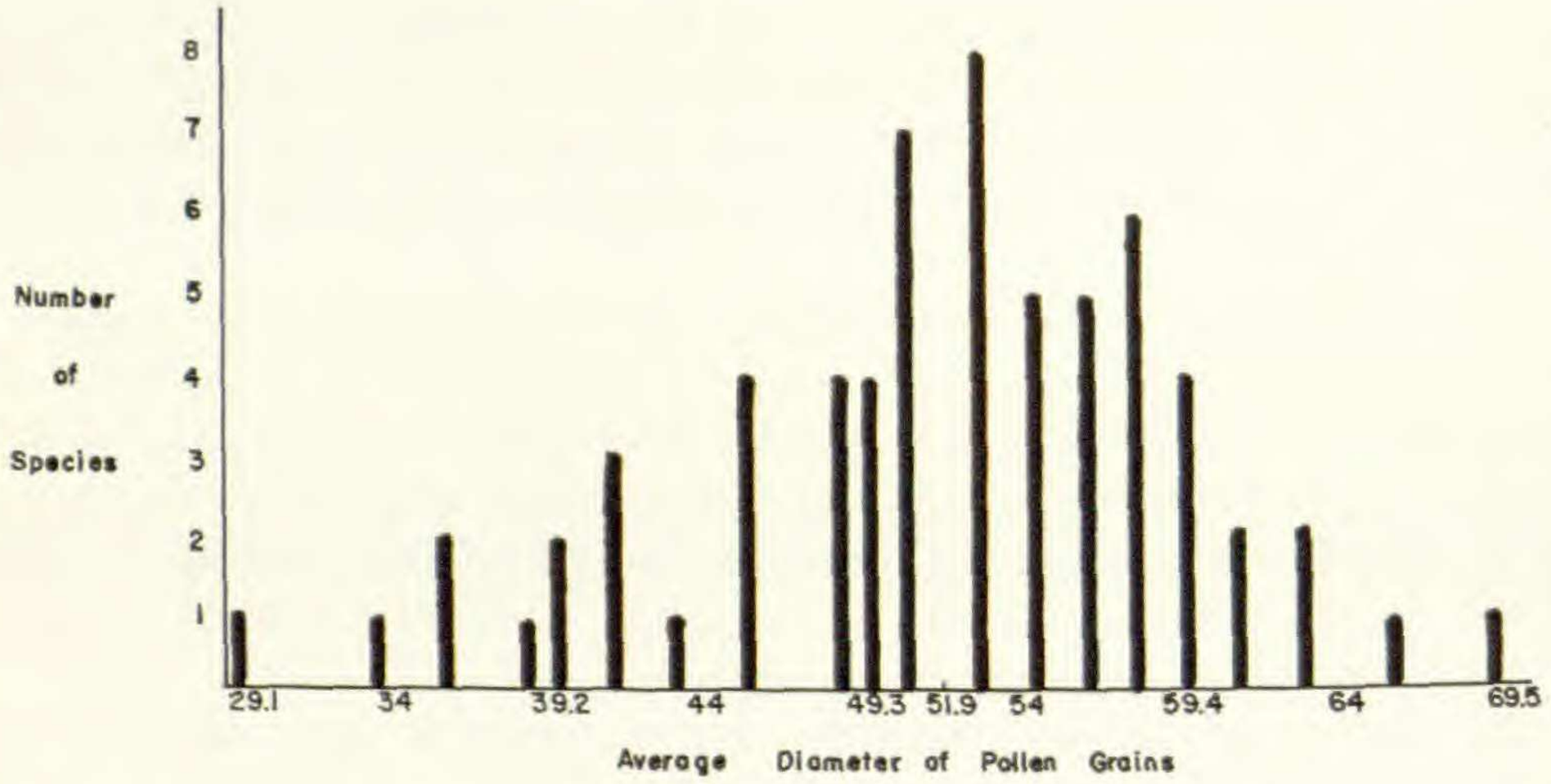

FIGURE 6. Graph illustrating the number of species of *Vernonia*, section STENGELIA, with pollen falling into each size class. Note that pollen size for most of the species falls near the median, 51.9μ.

The second group of species, *V. polyura* O. Hoffm., *V. filigera* Oliver & Hiern, *V. longipetiolata* Muschler, and *V. oxyura* O. Hoffm. in Engl., again agree well in pollen characteristics as well as in overall morphology, except for grain size in one species. The pollen grain size of three of the species ranges from an average diameter of 40.4 μ to 46.9 μ. The average pollen grain size of grains of *V. filigera* is 56.6 μ. It is hardly desirable to exclude the species from this grouping on this one feature alone, but it does necessitate another careful look at the specimens to be included here.

The break in size observed in the example cited above is perhaps better illustrated in the group of species clustered around the type species of the section, *V. adoensis* Sch.-Bip. ex Walp. On the basis of their gross morphology, these species fall readily into a group. An examination of the details of the achenes and flowers discloses no major discrepancy in the pattern. For the most part, the morphology of the pollen grains of these species supports the grouping. Average pollen diameters for most species of the group range between 56.6 μ and 63.0 μ. However, the average pollen grain diameters of *V. shirensis* Oliver & Hiern and *V. woodii* O. Hoffm. (which are now considered synonymous) are 46.9 μ.

The species of section STENGELIA fall into two distinct groups on the basis of plant habit. The bulk of the species are rank-growing upright sub-shrubs from a perennial base, or upright shrubby plants. A few may become tree-like. The pollen of many of these species has an average diameter of 50.1 μ or more, except for the species grouped around *V. polyura*. The reticulum on the grains is generally heavy.

The other group of species is distinguished by a rosette habit with flowers borne on a, usually, leafless scape. The scape may be unbranched and support a single head or it may support several heads. Many of the average pollen grain diameters for this group are less than 50 μ. The reticulation on the grains is often thin and very irregular. However, more exceptions occur among the species with basal rosettes than among the species with an upright habit. For example, the pollen of *V. gerberiformis*, which was previously described, is very different from the usual pattern of grain size and morphology. The grains of *V. nyassae* Oliv. in Hook., *V. pumila* Kotschy & Peyr. and *V. anandrioides* S. Moore have a heavy, regular reticulum. Furthermore, the grains of the last two have an average diameter of 53.3 μ. The pollen grains of the species with a basal rosette are more variable in size and morphology than are the pollen grains of the other species assigned to section STENGELIA.

In only three of the species examined, pollen grains of two size classes occurred. Both *V. calvoana* (Hook. f.) Hook. f. and *V. insignis* (Hook. f.) Oliver & Hiern have pollen grains similar in size and morphology. In both, the larger grains appeared to be normal. The smaller pollen grains appear to have been aborted. Because they were removed from herbarium specimens, it was impossible to apply germination tests for viability of the grains to confirm my assumption that the smaller grains are not functional. About half the pollen grains of *V. achyrocephaloides* Hutch. & Bruce were also smaller than the grains measured, and appeared to be nonfunctional. So little is yet known about the biology and genetics of species of section STENGELIA that I can make no assumptions as to the cause of the difference in pollen grain sizes. It is, perhaps, significant that all of the species have average pollen diameters near the upper limit of pollen size for this group of 64 species.

SUMMARY

A total of 64 species of *Vernonia*, purportedly belonging to section STENGELIA, were examined for pollen size and shape. Preparations from anthers, from herbarium specimens, macerated in lacto-phenol and methylene blue were examined and ten pollen grains from each slide were measured. Grouping in size from the smallest to the largest observed indicates that the largest number of species fall close to the average pollen diameter of 51.9 μ. Homogeneity is further emphasized by the reticulation, usually spiny, which covers the outer surface of all of the grains seen. When the species are regrouped on the basis of their gross morphological characteristics and detailed observations on

achenes and floral morphology, pollen morphology and average pollen diameter confirms the groupings for the most part.

The species traditionally included in section STENGELIA can be divided into a group with basal rosettes and heads borne on scapes versus a group of upright sub-shrubs or shrubs (rarely tree-like) with heads on the sides or ends of branches. In general the first group has smaller pollen grains with thin, irregular reticula. The second group generally has larger pollen grains with heavy, more regular reticula. The group with basal rosettes is less homogeneous than the other in regard to pollen size and morphology.

In only three species of the 64 examined were pollen grains of two size classes found. In all instances, the smaller grains appeared to be nonfunctional. All three species have pollen diameters in the upper size range. Insufficient knowledge of the biology and genetics of these species precludes an explanation.

TABLE 1. **Comparison of pollen characters with gross morphology of species of Vernonia section Stengelia**

SPECIES	POLLEN SIZE μ	RETICULATION THICKNESS	RETICULATION PATTERN	SPINES LENGTH	SPINES DISTRIBUTION	PROVENIENCE
V. albo-violacea	51.7	Medium	Regular	Almost none		*Bequaert 492*, Congo
V. brownii	56.6	"	Irregular	Short	Frequent	*Brown 2656*, Uganda
V. lasiopus	53.3	"	Regular	"	Occasional	*Volkens 444*, Tanzania
V. oxyura	40.4	Thin	±Regular	Medium	Numerous	*Buchanan s.n.*, Malawi
V. longipetiolata	42.0	Medium	Regular	"	Occasional	*Kassner 2746*, Congo
V. polyura	46.9	Thin	Irregular	Large	"	*Goetze 866*, Tanzania
V. filigera	56.6	Medium	"	Medium	Numerous	*Schimper 1530*, Ethiopia
V. nyassae	48.5	Heavy	Regular	Small	Frequent	*Thomson s.n.*, Zambia?
V. swynnertonii	51.7	"	Irregular	Short	±Numerous	*Swynnerton 1908*, Rhodesia
V. gerberiformis	66.3	Winged	"	None		*Schweinfurth 2688*, Sudan?
V. wittei	69.5	Medium	"	Short	Frequent	*de Witte 543*, Congo
V. chthonocephala	35.6	Thin	"	"	"	*Welwitsch 3886*, Angola
V. subaphylla	38.8	"	"	"	Few	*Carson 10*, Zambia
V. praemorsa	40.4	Medium	"	"	Occasional	*Stolz 104*, Malawi
V. agricola	43.6	Thin	"	Medium	Numerous	*Kassner 2136*, Zambia
V. castellana	48.5	"	"	"	"	*Gossweiler 2883*, Angola
V. anandrioides	53.3	Heavy	Regular	Short	Occasional	*Gossweiler 2132*, Angola
V. pumila	53.3	Medium	±Regular	"	Frequent	*Elliot 7037*, Kenya?
V. homilocephala	54.9	±Heavy	Irregular	"	Numerous	*Elliot 7058*, Kenya?
V. longepedunculata	50.1	Heavy	"	Short	Few	*Homblé 881*, Congo
V. pleiotaxoides	51.7	"	"	"	Frequent	*Quarré 2654*, Congo
V. procera	53.3	"	"	"	Numerous	*Chevalier 7899*, Congo?
V. lancibracteata	58.2	"	Regular	"	Frequent	*Eyles 291*, Zambia
V. firma	50.1	Medium	Regular	Short	Frequent	*Schweinfurth 3153*, Sudan?
V. vallicola	58.2	Heavy	"	Medium	"	*Gossweiler 3781*, Angola

TABLE 1. Comparison of pollen characters with gross morphology of species of Vernonia section Stengelia (*Continued*)

SPECIES	POLLEN SIZE μ	RETICULATION THICKNESS	RETICULATION PATTERN	SPINES LENGTH	SPINES DISTRIBUTION	PROVENIENCE
V. braunii	51.7	Heavy	Irregular	Medium	Numerous	*Braun 1979*, Tanzania
V. calvoana var. *microcephala*	53.3	Medium	Regular	Short	Frequent	*Lightbody 26259*, Cameroon
V. iodocalyx	53.3	"	"	Medium	"	*Holst 4327*, Tanzania
V. leucocalyx var. *acuta*	54.9	"	"	Short	"	*Keay & Lightbody 28366*, Cameroon
V. ruwenzoriensis	54.9	"	"	"	Numerous	*Elliot 7673*, Uganda
V. saltuarii	54.9	±Heavy	±Regular	Medium	Frequent	*Swynnerton 827*, Tanzania
V. leucocalyx	58.2	Medium	Irregular	Short	Occasional	*Goetze 928*, Tanzania
V. shirensis	46.9	Heavy	±Regular	Medium	Numerous	*Meller s.n.*, Mozambique
V. woodii	46.9	"	Regular	"	"	*Wood 8155*, South Africa
V. polymorpha var. *ambigua*	56.6	"	±Regular	"	"	*Schimper 817?*, Ethiopia
V. kotschyana	58.2	"	Irregular	"	"	*Kotschy 290*, Ethiopia
V. adoensis	59.8	"	Regular	"	Frequent	*Schimper 318*, Ethiopia
V. buchingeri	59.8	"	"	"	Numerous	*Schimper 386*, Ethiopia
V. polymorpha var. *adoensis*	59.8	"	"	"	"	*Schimper 823*, Ethiopia
V. grantii	63.0	"	Irregular	"	"	*Grant s.n.*, Uganda
V. rothii	48.5	Medium	"	"	"	*Roth 346*, Ethiopia
V. stenostegia	48.5	"	"	"	Occasional	*Robins s.n.*, Nigeria
V. stenolepis	53.3	Heavy	Regular	Short	Numerous	*Johnston s.n.*, Tanzania?
V. hymenolepis	58.2	Medium	Irregular	Medium	"	*Petit s.n.*, Ethiopia
V. calvoana	59.8	Heavy	Regular	Short	Occasional †	*Mann 1238*, Cameroon
V. insignis	61.4	"	"	"	" †	*Mann 1925*, Cameroon
V. polymorpha var. *microcephala*	50.1	Heavy	Regular	Medium	Occasional	*Schimper 581*, Ethiopia
V. tigrensis	51.7	"	"	Short	"	*Schimper 817*, Ethiopia
V. abyssinica	54.9	"	Irregular	"	"	*Schimper 389*, Ethiopia
Species not morphologically compatible with above groups						
V. praecox	29.1	Thin	Irregular	Short	Numerous	*Welwitsch 3330*, Angola
V. mandrarensis	33.9	Heavy	"	None		*Humbert 6724*, Madagascar
V. denudata	35.6	Thin	"	Long	Few	*de Witte 588*, Congo
V. crataegifolia	42.0	Medium	"	Medium	Occasional	*Tyson 1188*, South Africa
V. prolixa	42.0	Heavy	"	None	Occasional	*Elliot 8383*, Uganda?
V. anthelmintica *	46.9	"	Regular	Short	"	*Wight 3868*, India
V. bojeri	50.1	Medium	Irregular	None		*Bojer s.n.*, Madagascar
V. chevalieri	51.7	Heavy	"	Short	Frequent	*Chevalier 5505*, Congo?
V. guineensis var. *cameroonica*	51.7	"	Regular	"	"	*Latilo & Daramola 34467*, Cameroon
V. ulophylla	53.3	"	Irregular	Medium	Numerous	*Welwitsch 3279*, Angola
V. cardiolepis	56.6	"	Regular	"	"	*Welwitsch 3280*, Angola
V. rotundisquama	56.6	"	Irregular	Long	Frequent	*Gossweiler 1228*, Angola
V. incompta	58.2	Medium	"	Medium	Occasional	*Kassner 2261*, Rhodesia
V. hierniana	61.4	Heavy	"	"	Numerous	*Welwitsch 3278*, Angola
V. achyrocephaloides	63.0	Medium	"	Short	Occasional †	*Walter 4*, Zambia

* An Asiatic species all of whose relatives are African.
† Pollen of 2 size classes; largest measured, smallest apparently nonfunctional.

Total — 64 species examined.
Average pollen diameter — 51.9.

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A NEW SPECIES OF FICUS FROM SURINAME

GORDON P. DEWOLF, JR.

IN THE PROCESS of revising the genus *Ficus* for the *Flora of Suriname*, three specimens (taken from the same tree) were found which did not seem to match any of the previously known forms of the genus. Further study has convinced me that this tree represents an entity, sufficiently distinct from all others to be considered a species which has not been previously described.

It is perhaps of some interest to note that in the course of twelve years of intermittent study of *Ficus* in tropical America, this is the first time that it has been necessary for me to describe a new species in this group. Other undescribed taxa undoubtedly exist in tropical America — the highlands of Brazil probably harbor a few — but their numbers are unlikely to be large.

Ficus Lanjouwii, sp. nov.

Arbor, ramulis ca. 3–4 mm. diametro, crassis, brunneis, dense pubescentibus; stipulae 6–8 mm. longae, caducae, triangulares, acuminatae, dense adpressi-pubescentes; lamina oblanceolata 2.5–5 cm. lata × 7–14 cm. longa, acuminata, basi ima acuta, nervis lateralibus utrinsecus ca. 10–15, petiolo ad 5–15 mm. longo, adpressi-pubescente; receptacula globosi-pyriformia 8–9 mm. diametro; pedunculi geminati, 1–2 mm. longi, dense pubescentes; involucrum bilobum 1 mm. latum, dense pubescente; ostiolo haud prominente, 1 mm. lato.

Tree. Twigs 3–4 mm. in diameter, densely pubescent with ascending trichomes on new growth. Stipules 6–8 mm. long, acuminate, deltoid, densely appressed pubescent. Lamina 2.5–5 cm. wide × 7–14 cm. long, oblanceolate, apex acuminate, base cuneate; lateral veins 10–15 pairs, departing from the midrib at an angle from 20° to 30°; basal veins 1 pair, departing from the midrib at an angle from 50° to 60°; intercostals very slightly raised. Petiole 5–15 mm. long, 1/13–1/15 the length of the lamina, densely appressed pubescent. Figs 8–9 mm. in diameter ± globose-pyriform, borne in pairs among the leaves; peduncles 1–2 mm. long, densely appressed pubescent; basal bracts semicircular, about 1 mm. across, densely appressed pubescent; ostiole plane with the surface of the fig, about 1 mm. in diameter. Female and gall flowers about 1–1.2 mm. long, with 3 narrowly lanceolate tepals with hyaline margins. Scales present between the flowers.

Leaf structure: cystoliths few on the upper surface, more abundant on the lower surface; sclereids present generally along the veins; lower

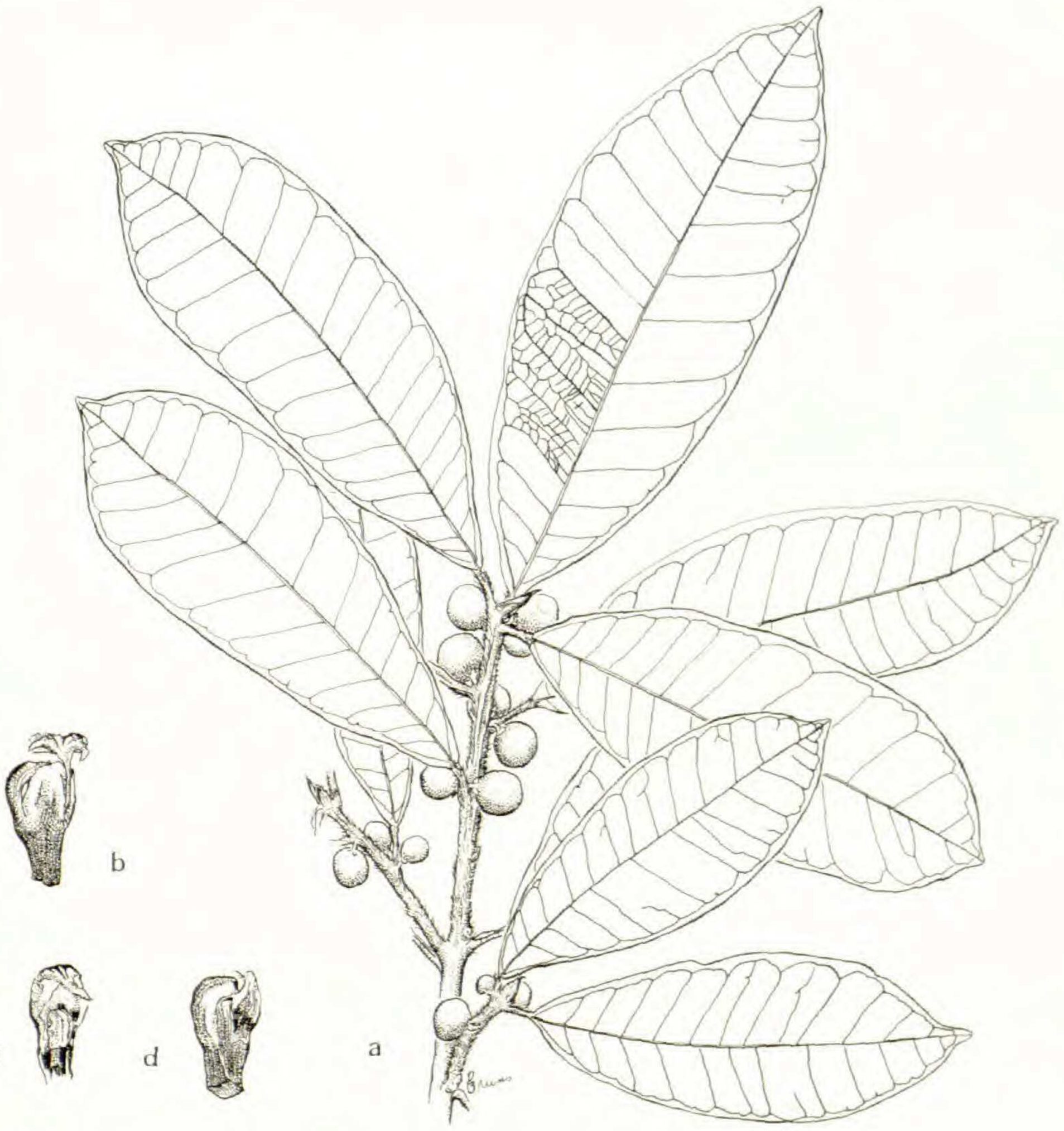

FIGURE 1. *Ficus Lanjouwii.* a, twig, × 1; b, female flower, × 15; c, d, male flower, × 15; e, lower surface of leaf, × 600, without cellular detail, showing tabular crystals of calcium oxalate along the veins, cystoliths (1) and druses of calcium oxalate (2); f, lower surface of leaf, × 600, showing cellular detail, at left, view of epidermis showing stomates and (top) a cystolith; at right, subepidermal view showing sclereids along the veins, tabular crystals of calcium oxalate along the veins, and druses of calcium oxalate (upper center and upper right).

epidermal cells plane; stomates superficial; druses present in the mesophyll cells; tabular crystal cells present.

This species appears to be allied to the widespread *Ficus trigona* L. f. It differs from that species in the greater number of lateral veins in the leaves (10 to 15 pairs *vs.* 3 to 9 pairs) and their lower angle of departure from the midrib; in the orifice of the fig not being surrounded by a raised rib of receptacular tissue; and in having the tepals of the flowers narrowly lanceolate (not hooded).

The species is known from three collections taken from a single tree between 1918 and 1922. I take pleasure in commemorating the name of the Senior Editor of the *Flora of Suriname*, who has been connected with studies of the Moraceae for more than thirty years.

TYPE SPECIMEN: Plantae Surinamenses, communicatae ex Herb. Acad. Rhenotraiect. Hab. Sectie O. Arbor no. 790, Coll. *B.W.*[1] no. *4639*, d. d. 21-iv-1920 (A, holotype; U, isotype).

Additional specimens: data as above, *B.W. 3639* (A, U); *B.W. 5859* (A, U).

[1] B.W. = Collection made by the Forestry Bureau (Boschwezen).

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